ACCESSION #: 9908030135

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: South Texas, Unit 1 PAGE: 1 OF 3

DOCKET NUMBER: 05000498

TITLE: Automatic reactor trip due to an over-temperature delta-

temperature actuation

EVENT DATE: 06/27/1999 LER #: 1999-006-00 REPORT DATE: 07/26/1999

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Scott Head - Licensing Supervisor TELEPHONE: (361) 972-7136

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: TG COMPONENT: CON MANUFACTURER: W120

REPORTABLE EPIX: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At approximately 1059 hours on June 27, 1999, Unit 1 experienced an automatic reactor trip due to an overtemperature delta-temperature actuation. All control rods fully inserted. The Engineered Safeguards Features System actuated the Auxiliary Feedwater System and Feedwater Isolation as expected for a reactor trip. All systems functioned as required. The plant was stabilized utilizing the Emergency Operating Procedures as expected. The over-temperature delta-temperature actuation resulted from spurious actuation of the main turbine overspeed protection control circuit momentarily causing the main turbine

governor and intercept valves to shut. The closing of the main turbine valves removed the primary heat sink from the reactor coolant system and resulted in a rapid increase in average reactor coolant temperature. The root cause of the spurious actuation was a degraded flag-lug connection for the -15 VDC power supply to the printed circuit card racks. Corrective action included re-crimping the failed flag-lug connection.

DESCRIPTION OF THE EVENT:

On June 27, 1999, Unit 1 was operating in Mode 1 at 100% power. On June 27, 1999, at approximately 1059 hours, the Unit 1 main turbine Overspeed Protection Control (OPC) circuit, located in the Analog Electro-Hydraulic control (AEH) cabinet, actuated spuriously. The circuitry energized relays, which in turn energized solenoids that closed the main turbine governor and intercept valves. Approximately 0.26 seconds later, the relays and solenoid valves de-energized. As designed, the governor valves were held shut for 5 seconds and then allowed to reopen and the intercept valves began to open as soon as the OPC signal was removed. The closing of the main turbine governor and intercept valves removed the primary heat sink from the reactor coolant system, resulting in a rapid increase in average reactor coolant temperature.

Approximately eight seconds after OPC solenoid energization, the resultant transient caused the reactor protection system to process channel II and III over-temperature delta-temperature signals. These two signals satisfied the two-out-of-four logic requirement for the reactor protection system, initiating a reactor trip on over-temperature delta-temperature. As designed, the reactor trip resulted in a main turbine trip. During the

transient, the pressurizer power operated relief valve 655A lifted and reset per design.

In response to the automatic reactor trip, all control rods fully inserted.

The Engineered Safeguards Features System actuated the Auxiliary Feedwater System and Feedwater Isolation as expected for a reactor trip. All systems functioned as required. The plant was stabilized utilizing the Emergency Operating Procedures as expected.

Troubleshooting efforts isolated the location of the fault to a degraded flag-lug connection on a -15 VDC power lead to the AEH controller cabinet. When disturbed, minor sparking at the lug and panel relay chatter were observed. Subsequently, the entire power panel was inspected by thermography. Three other suspect connections associated with +15 VDC power supply connections were identified. The one failed connection and three suspect connections were reworked by re-crimping the suspect lug connectors and checked satisfactory by thermography. Following the repair, simulation testing of the AEH controller was completed satisfactorily. Cycling the power supplies on and off resulted in no perturbations in AEH controller functions. The OPC circuitry was checked and found to be functioning properly in all respects.

Momentary loss of -15 VDC power to the card racks caused the AEH controller analog circuitry to fail to an indeterminate state. Reference voltages that are critical to AEH controller operation were forced outside of operational tolerances. Operation of all analog circuitry became

unpredictable and resulted in OPC circuitry actuation. OPC actuation resulted in closing the main turbine governor and intercept valves. The rapid closing of the governor and intercept valves caused a loss of load condition which resulted in a reactor coolant system temperature perturbation significant enough to produce an over-temperature delta-temperature reactor trip signal as well as the lift and resealing of pressurizer power operated relief valve 655A. Other effects of the loss of voltage were masked by the subsequent main turbine trip.

Unit 2 power supply wiring was examined by thermography and determined to be acceptable for continued operation.

CAUSE OF THE EVENT:

The root cause of the failure was a degraded flag-lug connection for the -15 VDC power supply to the printed circuit card racks. A contributor to this occurrence is the flag-lug type connections in the original AEH controller are inherently less secure than other types of connectors.

ANALYSIS OF THE EVENT:

Automatic reactor trips and Engineered Safeguards Features actuations are reportable pursuant to 10CFR50.73(a)(2)(iv). All safety systems functioned as designed during the occurrence. There was no significant risk to the health and safety of the general public or station personnel.

CORRECTIVE ACTION:

The failed flag-lug connector and several other suspect connectors were

recrimped and tested with thermography. Post maintenance testing with simulated main turbine inputs indicated that the problem was corrected.

ADDITIONAL INFORMATION:

As a result of this occurrence, other opportunities for enhancing plant reliability are being evaluated. These include:

o Evaluating current thermography practice and acceptance criteria for the AEH controller terminal points to determine better methods of identifying/analyzing loose connections.

o Evaluating overall thermography program and how trends are dealt with and actions levels determined for corrective action.

o Evaluating the feasibility of a modification to upgrade the AEH wiring to preclude known failure modes.

o Evaluating adding digital computer points to enhance troubleshooting efforts.

o Evaluating a plant change to replace the remaining flag-lug connections in the AEH cabinet with ring lug type connections (or similar secure connections) to prevent loose connections from affecting the AEH controller.

There has been one other Licensee Event Report submitted by the South Texas Project to the Nuclear Regulatory Commission regarding a similar event in the past three years.

o Unit 1 Licensee Event Report 97-012 involved an automatic reactor trip due to an over-temperature delta-temperature actuation when the main

turbine overspeed protection control momentarily energized due to a solid state relay failure in the control circuitry.

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